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ABSTRACT

A model for adult language learning should integrate theories in language acquisition with theories about learnability and proposals about adult language structures. Two particular problems in language acquisition are examined: (1) establishing what counts as a formal relationship in a particular domain, and (2) retreating from overgeneralizations without negative data with respect to the acquisition of morphology. The "inheritance principle" is proposed as a principle of both adult grammar and language acquisition. This principle is understood as follows: first, a derived form inherits the full subcategorization of its base unless the relation between the two forms is distant; and secondly, if a derived form is distantly related to its base, then only the unmarked portion of the subcategorization is inherited. The "inheritance model" suggests that overgeneralizations and subsequent retreat from overgeneralizations follow in a principled way from the formal relationships that learners posit between items. These two predictions of the inheritance principle were tested in a series of experiments with groups of children aged three to seven. The form of the model derived for the domain of morphology suggests parallel models for other domains of grammar and a programmatic approach to the study of overgeneralization and retreat in language acquisition. (AMH)

The Inheritance Model: making and breaking morphological relationships

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If work in language acquisition is going to come together with theories about learnability and proposals about adult language structures, then a successful approach will have to consider all three of these areas in looking for an explanatory theory. The most reasonable theory might, at first, look inelegant when considered in relation to just one area. When set in the context of the other two, though, it might turn out to be the model with the most explanatory power.

This paper is an effort toward just this kind of integration. We will begin with a general discussion of the acquisition problem. Then we will look at one particular area of the adult grammar being acquired -- derivational morphology. We propose the Inheritance Principle as a core principle in morphology, and then examine it with respect to learnability -- how it would operate as a model for the learning of morphologically complex forms. The implications of such a model are then tested in a set of experiments.

1. Acquisition: general considerations

The problem of language acquisition can be looked at as two interrelated problems. One problem the child confronts is to figure out what relationships between individual items in the language "count" as formal relationships, in each of the grammatical domains. For example, the relationship that holds amone all the words which contain a /p/ somewhere in them is a relationship that a learner could use to make up a generalization about his language. Or, the relationship between a word and its intonation.

But while these are plausibly significant relationships in certain contextx, they are insignificant in the domain of morphology. An affixation rule doesn't care whether somewhere in the form it's attaching to there is a /p/, nor does it care about whether a morphological base form has a rising or a falling contour. In contrast, it might care about the relationship that holds, among, say, all

verbs that end in voiced consonants. A rule like past-tense needs, in fact, to look at this. A learner's predosposition to recognize certain of these relationships is no doubt specified by the language acquisition device. Other relationships, however, are not automatically recognized. As a consequence of this, this is the place where a learner will make errors.

A second problem follows from this one. Once the learner has begun to establish particular relationships between forms, and construct preliminary rules, he may go too far, overgeneralizing the rules to forms they should not affect. The problem which results has been called (by Baker and others) the negative evidence problem. Basically: how does the learner retreat from overgeneralizations without access to information that particular forms are not grammatical.

Both of these problems -- establishing what "counts" as a formal relationship in a particular domain, and retreating from overgeneralizations without negative data -- arise in the acquisition of morphology, in the learning of forms which are morphologically complex. We look at these forms below.

2. The target grammar ← morphologically complex forms

Let us consider verbs and their deverbal counterparts, first deverbal nominals. In (1) - (3), the a. forms are the verbs, the b. forms are the -ing 'process' nominals and in c., marked with an ampersand, are -er agent nominals.

(1) a. to ride bicycles without hands
b. the riding of bicycles without hands
c. &the rider of bicycles without hands

(2) a. to break taffy into bite-sized pieces
b. the breaking of taffy into bite-sized pieces
c. &the breaker of taffy into bite-sized pieces

(3) a. to discover manuscripts under beds
b. the discovering of manuscripts under beds
c. &the discoverer of manuscripts under beds

The ampersand indicates not that every reading of these is bad, but that the

reading we are aiming at here -- the one in which both complements are arguments of the verb -- is ungrammatical. In (1c), then, we're talking about someone who rides bikes without using any hands, not about bikes without hands nor about a person without hands, both of which are grammatical, if silly.

Despite the fact that the b. and c. forms are both related to the verbal a. forms, that is, they're both deverbal nominals, only the b. forms can take the full range of the verb's arguments. The problem is not a semantic one. Each of these c. forms would be interpretable; (1c), would mean, as we have said, someone who rides (or is riding) a bike in a particular way; (2c), someone who breaks taffy into bite-sized pieces, and so forth. But the only reading available is one in which the second argument is not an argument of the verb but modifies either the higher or lower NP. In (1c), for example, without hands can refer either to the rider of the bike or the bike, either of which would have no hands.

Allen (1976) has used the term "inheritance" to describe these facts informally. In looking at cases which contain at most direct objects she notes, "deverbal nominals in -er and -ing inherit the subcategorizations of the verb." (p. 170) This is a simplification, though, as we have seen for the -er cases in (1) - (3), which prohibit more than a direct object. Examples (4) - (7) are a better test; they are verbs which require two complements. Note that the problem is not with one or two complements: the examples in (8) - (10) only require one complement, but these are not direct object NPs, they are PPs.

(4) a. put NP PP_{loc}
b. the putting of men on the moon
c. &the putter of men on the moon

(5) a. hand NP PP_{dat}
b. the handing of scalpels to surgeons
c. &the hander of scalpels to surgeons

(6) a. place NP PP_{loc}
b. the placing of students in colleges
c. &the placer of students in colleges

(7) a. glue NP Adv
b. the gluing of the pieces together

(7) a. glue NP Adv PP
b. the gluing of the pieces together
c. &the gluer of the pieces together

(8) a. lean PP
b. this leaning against walls
c. &this leaner against walls

(9) a. turn PP Adj
b. this turning into a pumpkin has got to be stopped
c. &this turner into a pumpkin has got to be stopped

Once again, the c. cases are odd, suggesting a principle more restrictive than Allen's informal statement.

In (11) we propose such a principle, the Inheritance Principle.

(11) the Inheritance Principle:

a. a derived form inherits the full subcategorization of its base unless the relation between the two is distant, i.e. differs in two respects, category and meaning;

b. if a derived form is distantly related to its base, then only the unmarked portion of the subcategorization is inherited, transitive or intransitive (see Carlson & Roeper, 1980).

This principle (which will have to be made more explicit with respect to "change of meaning") will account for the differences between the b. and c. cases in (1)-(9). In -ing affixation, there is a change of category -- a verb becomes a noun -- but the only meaning change is that which the new category brings to the form. No extra meaning component is added. In the -er examples, however, the affix carries a meaning of its own, agent of action. So in addition to the change of category, there is also a change of meaning. With these two changes, the Inheritance Principle allows only an unmarked subcategorization.

We can see a similar pattern in (12) - (14) with the -able affix, which changes verbs into adjectives and adds the basic meaning "able to be V-ed".

(12) a. break the taffy into bite-sized pieces
b. &the taffy is breakable into bite-sized pieces

(13) a. ride this bike without hands
b. &this bike is rideable without hands

(14) a. divide the pie into thirds
b. &the pie is dividable into thirds
c. the pie is divisible into thirds (from Aronoff, 1976)

Note that (14), divide, has a possible alternative, divisible, which can take extra complements, in contrast to dividable, formed with the productive -able rule. (This contrast was originally pointed out in Aronoff (1976). Presumably, divisible would have a separate lexical entry (would not be formed by rule) and its subcategorization would specify that it takes a PP.

According to the Inheritance Principle, if the full subcategorization is to be inherited, then category and meaning may not both change. The -ing cases showed the category changing while the meaning remained constant. The cases in (15) - (17) illustrate the meaning changing while the category remains constant.

(15) rehand the scalpel to the surgeon

(16) replace the students in summer jobs

(17) reglue the pieces together

Here re- adds the meaning 'again' but does not change the category; hand and rehand are both verbs. These examples are parallel to (5) - (7). In similar fashion, we would expect (4) to allow the corresponding (18),

(18) reput the men on the moon

but we don't. This fact, will, for the moment, have to remain unexplained.

3. Learnability

The Inheritance Principle, as it was proposed above, is a principle governing the adult grammar. Its form, however, makes it a candidate for a principle governing acquisition. We repeat it below.

(11) the Inheritance Principle:

a. a derived form inherits the full subcategorization of its base unless the relation between the two forms is distant, i.e. differs in two respects, category and meaning.

b. if a derived form is distantly related to its base, then only the unmarked portion of the subcategorization is inherited: transitive or intransitive.

When viewed as a learning model, it makes two plausible predictions. We state them in (19).

(19) (i) learners will overgeneralize verbal modifiers in all deverbal forms, unless the form is seen as distantly related to its base

(ii) a child will automatically retreat from overgeneralization -- without negative evidence -- as soon as he finds data indicating that a deverbal form is distantly related to its base (differs in both category and meaning

The Inheritance Model, then, suggests that overgeneralizations and subsequent retreat from overgeneralizations follow in a principled way from the formal relationships that learners posit between items. If a learner encounters a new form and sees only that it is related to a form with which he is familiar, but knows nothing else about it, he will assume that it inherits the properties of the base form which he knows. Once he finds that the new form is sufficiently different from its base -- differs in two critical respects -- then he will stop treating it identically with the base form and give it independent status. Finding differences between the new form and the old one will be possible from positive evidence alone: changes of category will be available from the syntactic environment; changes in meaning will be available from the contextx in which the form is used. The learner will be able to add information (about category and meaning, among other types) solely from the input data that he is exposed to.

4. Acquisition data

The predictions of the Inheritance Model were tested in a series of experiments.

The first experiment tested a group of children between 3 and 7 on their interpretations of the -er type forms, the -er nominals which don't allow inheritance. Some examples appear in (20).

(20) a. a diver without a mask
b. a drummer without sticks
c. a rider of a bike without hands

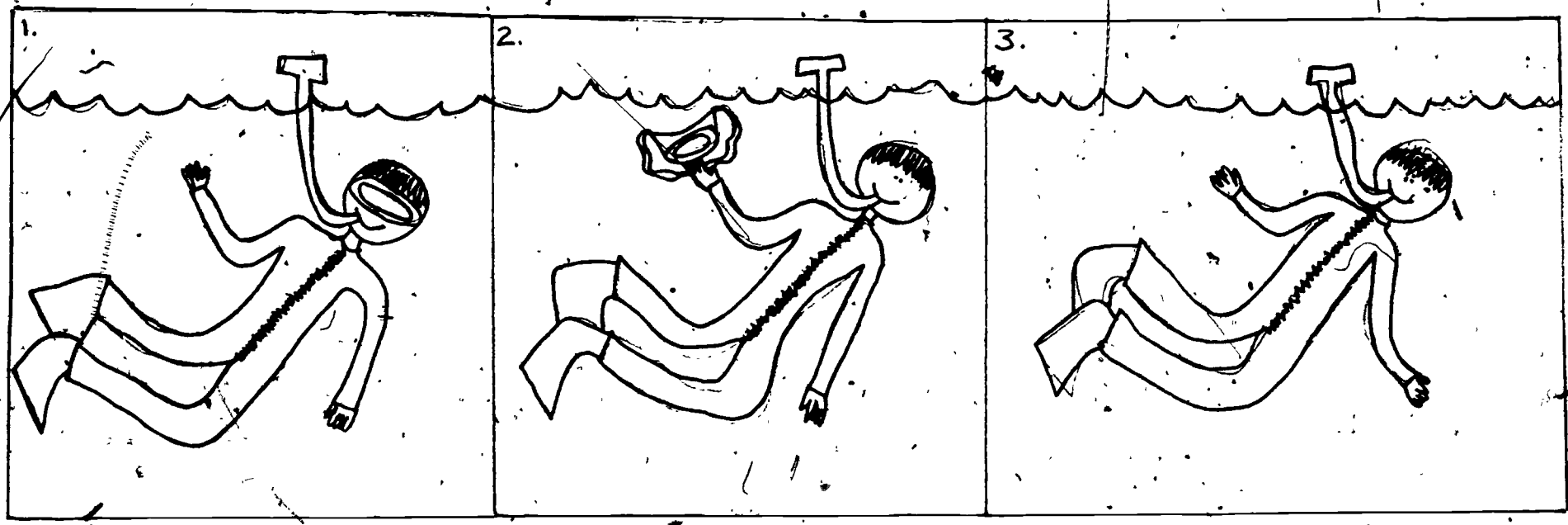
We tested these same children on the corresponding verb forms, given in (21). Throughout, we used the progressive forms, a sample of which appears in (22).

(21) a. dive without a mask
b. drum without sticks
c. ride a bike without hands

(22) a man diving without a mask

The test went as follows. Each child was shown a group of 3 picture cards (shown below) and asked, for example, "Can you show me all the pictures of a diver without a mask?" or "Can you show me all the pictures of a man diving without a mask?", either the noun form or the verb form. For the -er, noun, form, a diver without a mask, the only correct response is picture 3, since here, the diver has no mask. Picture 2 is not correct, since a mask appears in the picture. The man here is a diver with a mask. For the verb form, a man diving without a mask, there are two correct responses, both 2 and 3. In both of these, the action is occurring without the use of the mask.

Picture 2, then, is the crucial case. It is correct only for the verb and not for the noun form.


1.
2.
3.

Before we look at the children's responses, we should look at the responses from a group of 12 University of Massachusetts undergraduates who served as controls for the experiment. The right hand column of Table 1 gives their responses.

Table 1 Percentage of responses for which each picture was selected as an instance of the phrase

	children	adults
	n=18	n=12
a diver without a mask		
*1	0%	0%
*2	82%	0%
3	100%	100%
a man diving without a mask		
*1	0%	0%
2	100%	100%
3	100%	100%

None of their responses included picture 1, none included 2, but all of their responses included picture 3 for the -er noun forms. The verb forms they treated differently: none of their responses included 1, but all included both 2 and 3.

The children's responses appear in the left hand column. If we look at the bottom set, the verb responses, we see that they are identical to the adult pattern. Both 2 and 3 were always chosen as a man diving without a mask. But if we look at the top set we see a tremendous contrast. While none of the adults chose 2, 82% of the children did choose it, treating the -er form incorrectly as an inheriting form. (There were no age effects among the children.)

We see, then, the first prediction of the Inheritance Model borne out: the children are treating derived forms like their bases, inheriting all the verbal subcategorization into the -er form, overgeneralizing inheritance. The second prediction of the Inheritance Model concerns retreat from overgeneralization. Once the children are familiar enough with an affix to know the types of changes it invokes on a base,

they will get the inheritance facts right automatically. In this case, once the child learns that -er changes both category and meaning, they will stop inheriting the complements in these forms.

To test how well an affix is understood poses a difficult question. We assumed, however, that a child would not use an affix productively until he knew what it did. Therefore a production task served as a test for whether a child knew the affix. The prediction is that once -er is understood completely (i.e. mastered in production), inheritance will cease, since the child will know that -er changes both the category and the meaning of the base it attaches to. Until then, before children have mastered -er, they will inherit.

A new group of children all between 5 and 6, were tested in these two tasks. The comprehension task was the one just described. The production task was the familiar nonsense form task. The child was shown a picture of a person doing some activity for which there is no one-word name, (for example, a picture of a girl rolling out a roll of paper onto a table) and is told, "This is Mary. She's zibbing. Can you say that?" The child is asked to repeat the form, to inflect it another way (for example "Yesterday she _____."), and then to produce the -er agent form, "What would you call someone whose job it was to zib?" The child was to say "zibber".

The data appear in Table 2, and are remarkably close to the predictions.

Table 2 Correlation of responses to -er production and without a comprehension tests (n= 12)

		production test	
		-er not mastered	-er mastered
comprehension	inheriting PPs	5	1
	not inheriting PPs	0	6

All of the children who had not mastered -er (the two left boxes) are inheriting complements. Of the children who had mastered the affix productively, 6 out of 7 (the right hand column) are not inheriting. This result was highly significant ($p < .01$). Once the children have worked out the affix, inheritance disappears, exactly what prediction (ii) of the Inheritance Model states.

To summarize briefly: we discussed the Inheritance Principle as a proposal for the adult morphological system, then considered it as a model in acquisition. We showed how it could account for overgeneralization, as well as eliminate the need for negative evidence. The experiments support both predictions. They show initial overgeneralization and subsequent retreat, with exactly the expected correlation.

While the Inheritance Model is aimed at the types of relationships that hold between items in the domain of morphology, its form suggests parallel models for other domains of the grammar, and a programmatic approach to studying overgeneralization and retreat in language acquisition. Inasmuch as the Model was derived from a principle governing the adult system; its success provides support for a research program which considers adult language structures, learnability and acquisition data together in theories about human language.

References

Allen, M.R. (1978) Morphological Investigations. PhD. Dissertation, University of Connecticut, Storrs.

Aronoff, M. (1976) Word Formation in Generative Grammar. Linguistic Inquiry Monograph /1. MIT Press, Cambridge.

Baker, C.L. (1979) Syntactic theory and the projection problem. Linguistic Inquiry 10, 533-581.

Carlson, G. and T. Roeper (1980) Morphology and subcategorization, in T. Hoekstra, H. van der Hulst and M. Moortgat, eds. Lexical Grammar. Foris, Dordrecht.

Roeper, T. and M. Siegel (1978) A lexical transformation for verbal compounds. Linguistic Inquiry, 9, 199-260.